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QUALIFICATION WORK

on the topic: **«DEVELOPMENT OF THE COMPOSITION OF ANTIBACTERIAL SOAP WITH A COMPLEX OF ESSENTIAL OILS»**

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ANNOTATION

The qualification work is devoted to the research to develop the composition of antibacterial soap, the active pharmaceutical ingredient of which is a complex of essential oils of cedar, chamomile, and orange.

The qualification work is set out on 48 pages of typewritten text, consists of an introduction, three chapters, general conclusions, a list of references and 2 appendices. The bibliography contains 40 sources. The work is illustrated with 8 tables and 7 figures.

Key words: soap, antibacterial, cedar essential oil, chamomile essential oil, orange essential oil, technology.

АНОТАЦІЯ

Кваліфікаційна робота присвячена дослідженням з розробки складу антибактеріального мила, активним фармацевтичним інгредієнтом якого є комплекс ефірних олій кедру, ромашки та апельсину.

Кваліфікаційна робота викладена на 48 сторінках машинописного тексту, складається зі вступу, трьох розділів, загальних висновків, списку використаних літературних джерел і 2^x додатків. Список літератури містить 40 джерел. Робота ілюстрована 8^{ма} таблицями та 7^{ма} рисунками.

Ключові слова: мило, антибактеріальний, ефірна олія кедру, ефірна олія ромашки, ефірна олія апельсину, технологія.

CONTENTS

INTRODUCTION	5
CHAPTER 1. HAND HYGIENE: RECOMMENDATIONS FOR	
HEALTHCARE WORKERS AND PATIENTS	8
1.1 Peculiarities of hand hygiene of medical and pharmaceutical workers	8
1.2 Peculiarities of patient hand hygiene	11
1.3 Advantages of using essential oils in comparison with classic	
antibacterial agents	12
Conclusions to chapter 1	22
CHAPTER 2. RESEARCH OBJECTS AND METHODS	23
2.1 Objects of research	23
2.2 Methods of research	24
Conclusions to chapter 2	24
CHAPTER 3. DEVELOPMENT OF THE COMPOSITION OF ANTI-	
BACTERIAL SOAP BASED ON A COMPLEX OF ESSENTIAL OILS	25
3.1 Study of the range of the domestic market of soap with an antibacterial	
effect	25
3.2 Justification of the composition of antibacterial soap with a complex of	
essential oils	26
3.3 Justification of the technology for the production of antibacterial soap	
with a complex of essential oils	32
3.4 Calculation of the cost of antibacterial soap with a complex of essential	
oils	33
Conclusions to chapter 3	35
GENERAL CONCLUSIONS	36
REFERENCES	37
APPENDIXES	42

LIST OF CONVENTIONAL ABBREVIATIONS

- API Active pharmaceutical ingredient
- BAR biologically active substance
- BP British Pharmacopoeia
- WHO World Health Organization
- SPU State Pharmacopoeia of Ukraine
- EP European Pharmacopoeia

INTRODUCTION

Actuality of the topic. Healthcare-associated infections affect hundreds of millions of people worldwide each year. Hands are the main route of transmission of microorganisms in health care. Therefore, hand hygiene is the main preventive measure for patients against the transmission of infections when providing them with medical care.

Millions of microbes constantly live on our hands, most of them are not dangerous for our health, but some are the cause of various diseases such as colds, flu, stomach upset, possible infectious skin diseases. When we forget or simply do not want to wash our hands, we become involuntary carriers of these microorganisms.

The following types of hand skin microflora are distinguished: resident flora (microorganisms constantly live on the skin and protect it); infectious flora (causing agents of skin infections); transient flora (causing agents of nosocomial infections).

Timely hand washing helps to remove the microorganisms of the transient microflora of the skin of the hands, before dangerous microbes reach another person or surface.

In modern conditions of the spread of respiratory diseases, hand hygiene requires a responsible approach from both medical and pharmacy workers and patients. Compared to ordinary soap, antibacterial soap has many advantages as a reliable barrier to the entry of pathogens of viral and infectious diseases. On the other hand, the constant use of antiseptics leads to a violation of the natural microbiological balance of the skin and the habituation of the pathogenic microflora to the antibacterial agent. Therefore, it is extremely important to use products of natural origin, namely essential oils, to treat the skin of the hands in order to ensure a powerful antibacterial effect with minimal damage to the natural microflora of the hands and the absence of the problem of habituation among pathogens. The aim of our work is to develop the composition of antibacterial soap based on ingredients of natural origin, where the active pharmaceutical ingredients are a mixture of essential oils of cedar, chamomile and orange.

Tasks of the study

To achieve the aim, the following tasks were set:

• to study modern recommendations for hygienic treatment of hands;

• to analyze the range of products in the form of soap with antibacterial properties;

• to develop the composition of antibacterial soap with a complex of essential oils;

• to justify the technology of manufacturing soap of the proposed composition.

Object of study. Pharmaceutical development of antibacterial soap based on ingredients of natural origin, where the active pharmaceutical ingredients are a mixture of essential oils of cedar, chamomile and orange.

Subject of study. Development of an antibacterial soap composition based on ingredients of natural origin, where the active pharmaceutical ingredients are a mixture of essential oils of cedar, chamomile and orange.

Methods of research. When solving the tasks set in the qualification work, bibliosemantic, well-known organoleptic (appearance, smell, color), organizational, economic and mathematical (statistical processing of results) research methods were used, which allow to objectively evaluate the qualitative and quantitative indicators of the investigated soap samples on based on experimentally obtained and statistically processed results.

Practical significance of the obtained results. A medicinal and cosmetic product with an antibacterial effect based on a complex of essential oils of cedar, chamomile and orange in the form of soap is offered.

Implementation of results and publication. Based on the materials of the qualification work, 1 thesis was published (see Appendix A).

Structure and scope of qualification work.

The qualification work is laid out on 48 pages of typewritten text, consists of an introduction, three sections, general conclusions, a list of reference literary sources and 2 appendices. The bibliography contains 40 sources. The work is illustrated with 8 tables and 7 figures.

CHAPTER 1

HAND HYGIENE: RECOMMENDATIONS FOR HEALTHCARE WORKERS AND PATIENTS

1.1 Peculiarities of hand hygiene of medical and pharmaceutical workers

Hygiene is one of the oldest areas of medical knowledge, a science whose purpose is health protection and prevention of human diseases. This is the science of preserving, strengthening and improving the health of society.

The main tasks of hygiene are the study of the interaction of the human body with the environment and the influence of various natural and social factors on it, aimed at preventing diseases, strengthening health, and prolonging human life.

Special attention is paid to hand hygiene in medical and preventive institutions. The hands of medical personnel are one of the key factors in the transmission of pathogenic microorganisms both from medical personnel to patients and from patients to medical personnel [38-40].

Hand treatment (washing and disinfection) is one of the most effective measures for the prevention of infections, which ensures the protection of both medical personnel and patients.

Microorganisms in health care facilities can be transmitted through direct and indirect contact of medical personnel with patients. Moreover, under the conditions of a hospital, it is the direct contact of the medical staff with the patient that plays a major role in the transmission of infections.

All microorganisms found on the skin of the hands are divided into 2 categories: transient and resident microflora.

Transient microflora is represented by microorganisms that colonize the surface layers of the skin and has the greatest epidemiological significance. It is often acquired by medical personnel as a result of direct contact with the patient or contaminated environmental objects near patients. It is the transient microflora that is most often responsible for the development of infections associated with the provision of medical care in a nursing home.

Representatives of the transient microflora live on the skin of the hands for a short time, in some cases it is more than 24 hours. They can be easily removed by ordinary hand washing, and even more so when washing/treating hands with antiseptic agents. When the skin of the hands is damaged, including as a result of the use of inadequate hand washing and disinfection methods, transient microorganisms are able to colonize the skin for a long time, forming a new, much more dangerous resident microflora.

The resident microflora is represented by microorganisms that colonize the deeper layers of the skin, including sebaceous and sweat glands, as well as hair follicles. Its composition depends on many factors: localization, age, gender, profession, expressiveness of hair growth, humidity, temperature and pH of the skin, its hygienic condition, the presence of skin pathology and somatic diseases, as well as the season.

The largest number of resident microorganisms of the skin of the hands is found around the nails and under the nails and, to a lesser extent, in the spaces between the fingers [39, 40].

General requirements for hand hygiene:

- it is recommended that the nails be cut short at the level of the fingertips, without varnish coating and cracks on the surface of the nails, without false nails;
- bracelets, watches, rings are removed before hand treatment;
- in the room where hand treatment is carried out, the washbasin is located in an easily accessible place, equipped with a faucet with cold and hot water and a mixer, which should preferably be operated without touching hands, and the water jet should be directed directly into the drain siphon to prevent splashing of water.

Hand treatment is: hygienic washing, hygienic hand antiseptic, ordinary washing, surgical treatment, which includes ordinary washing and surgical antiseptic.

Hygienic treatment of hands includes the usual washing of hands with water and ordinary (non-antimicrobial) soap and hygienic hand antiseptic, i.e. rubbing an alcohol antiseptic, without the use of water, into the skin of the hands in order to reduce the number of microorganisms on the skin of the hands.

Regular hand washing with a non-antimicrobial detergent is recommended:

- at the beginning and end of the working day;
- before preparing and serving food;
- always before treatment with an antiseptic, when the hands are clearly dirty;
- after using the toilet;
- in all other cases in the absence of risk of infection or special instructions [39, 40].

Hygienic hand antiseptic is recommended before:

- entrance to aseptic premises (preoperative, sterilization departments, resuscitation department, etc.);
- performing invasive interventions
- activities that may cause infection
- every direct contact with patients;
- transition from an infected to a non-infected part of the patient's body;
- contact with sterile material and instruments;
- using gloves.

After:

- contact with contaminated objects, liquids or surfaces;
- contact with introduced drains, catheters or with the place of their introduction;
- every contact with wounds;

- every contact with patients;
- removing gloves;
- using the toilet.

Normal washing is intended exclusively for mechanical cleaning of hands, while dirt, sweat, partially washed away spore-forming bacteria, as well as partially other transient microorganisms are removed from the hands [38].

Hygienic antiseptic

The standard method of rubbing an antiseptic contains 6 stages. Each stage is repeated at least 5 times.

Antiseptic in the amount of at least 3 ml is poured into the hollow of a dry palm and vigorously rubbed into the skin of the hands and wrists for 30 seconds. is regulated. The last portion of the antiseptic is rubbed until completely dry. Wiping hands is not allowed.

When performing hand treatment, the presence of the so-called "critical" areas of the hands that are insufficiently moistened with antiseptic is taken into account: thumbs, fingertips, interdigital areas, nails, peri-nail ridges, and under-nail areas. The surfaces of the thumb and the tips of the fingers are treated most carefully, since the largest number of bacteria is concentrated there.

Among the errors of hygienic antiseptics, it is possible to rub the alcohol antiseptic into hands wet from water, which reduces its effectiveness and tolerability [38-40].

1.2 Peculiarities of patient hand hygiene

When should you wash your hands with soap and water?

After using the toilet, urinal or toilet seat.

If the hands are dirty in appearance.

Before eating or cooking.

If you have an infection caused by the bacteria clostridium difficile (C. diff) or norovirus.

After vomiting or expectorating sputum (mucus).

How to properly wash hands with soap and water?

Wet your hands with warm water. If possible, use liquid soap. Take enough soap to cover both hands.

Rub side to side until foam is formed. Scrub the foam on the back of your hands, between your fingers, and around and under your nails.

Continue rubbing your hands for at least 20 seconds.

Wash your hands thoroughly under warm water.

Dry your hands with a paper towel.

Using a dry paper towel, turn off the faucet and open the toilet door if necessary.

When should you treat your hands with an alcohol-based antiseptic??

In the absence of water and soap.

Leaving the hospital room and returning to it.

Before eating.

If you can't get out of bed, you can use the hand wipe in the package.

How to properly treat hands with an alcohol-containing antiseptic?

Take enough antiseptic to cover both hands.

Rub your hands thoroughly, then wipe the back of your hands, the area between your fingers, and around and under your nails with antiseptic.

Continue rubbing your hands until they are dry. If you have used an amount of antiseptic that is sufficient to kill the microorganisms, you need to rub your hands for at least 20 seconds before you feel that your hands are dry. Do not rinse your hands with water or dry them with a towel [39, 40].

1.3 Advantages of using essential oils in comparison with classic antibacterial agents

Essential oils are a complex mixture of fragrant, volatile organic compounds. There is a large number of published articles highlighting the antimicrobial activity of various essential oils from different parts of the world. Published scientific literature shows that essential oils have a wide range of antibacterial, antifungal and even antiviral effects. It is also known that essential oils inhibit the growth of drug-resistant strains of microbes that are even difficult to treat with conventional antibiotics. As for their mechanism of action, in fungal pathogens, essential oils create a membrane potential across the cell wall and disrupt ATP assembly, leading to cell wall damage. Essential oils can also destroy the mitochondrial membrane, interfering with the path of the electron transport system. In bacterial pathogens, essential oils primarily destabilize cellular architecture, leading to disruption of membrane integrity, disrupting many cellular activities, including energy production and membrane transport. Membrane rupture caused by essential oils can lead to leakage of cellular components and loss of ions [1, 2, 4, 26, 27].

Cedar essential oil (fig. 1.1)



Fig. 1.1 Cedar: a – Atlas, b – Lebanese, c – cedar essential oil

In ancient times, the name "cedar" belonged to the sacred Lebanese cedar (Cedrus libani), from the aromatic wood of which temples were built (for example, the temple of King Solomon in Jerusalem or the gate of the temples in ancient Egypt), and resin was also used for religious incense. Nowadays, the natural populations of the cedar of Lebanon are almost completely exterminated.

At the same time, in different areas, the name "cedar" was used for local conifers with fragrant wood. For example, the Siberian pine (Pinus sibirica) is called the "Siberian cedar", in the USA and Mexico the Texas cedar is called the

Mexican juniper (Juniperus mexicana), and the southern red cedar is called the Virginian juniper (Juniperus virginiana).

At present, essential oils are used in the industry, which are called "cedar", but are produced from the wood of different botanical classifications of plants: Atlas cedar, Himalayan cedar, and some types of juniper, cypress, and cypress. Common to these oils is the presence in their composition of the tricyclic sesquiterpene alcohol cedrol (cedrol), which is a valuable component for the perfume industry, where it and its derivatives are used as fixatives [12, 13, 15].

Varieties and their characteristics of cedar essential oil are described in the table 1.1.

Table 1.1

Essential oil	INCI	Method of production	Description
Atlas cedar oil	Cedrus Atlantica Wood Oil	Steam distillation	A yellow or clear liquid with a warm, mild, persistent balsamic odor with woody and resinous notes.
Himalayan cedar oil	Cedrus Deodora Wood Oil	Steam distillation	Light fluid oil from colorless to yellowish color with persistent and dry, woody-coniferous, slightly smoky and balsamic, with a faint spicy note, aroma.
Chinese cedar oil	Cupressus Funebris Wood Oil	Steam distillation	Viscous colorless, light yellow or light brown liquid with a mild, very persistent cedar smell.
Texas cedar oil	Juniperus Mexicana (Texas Cedarwood) Oil	Steam distillation	A viscous yellow liquid that has a woody, fresh, bitter, balsamic, reminiscent of sandalwood, but drier, aroma.

Types of cedar essential oil by origin

In production:

- perfumes cedar has a clean woody aroma, slightly reminiscent of sandalwood. It gives the perfume a dry taiga note and perfectly balances the other components. The woody note of cedar is combined with other woody accords, as well as with spices and flowers. Most often, it sounds in the loop of the composition, being a fixer of the smell. The cedar note is equally popular in both men's and women's fragrances;
- cosmetic products it is used to enrich creams, tonics, shampoos, rinses that are used for problem skin and hair, it increases blood flow and helps tissue respiration. It is also used in cosmetology as a rejuvenating agent that increases the tone and elasticity of the skin, can be an excellent component in emollients for cleaning the skin from crusts, various purulent manifestations. Aftershave creams for men, mattifying products for oily skin, hair masks, ointments for scratches and sores on the body are made with cedar essential oil. In soap making, cedar oil is a frequent component of bath soap, as well as shaving soap;
- household products for flavoring cleaning products;
- repellents can be used in mosquito repellents.

In the beauty industry:

- Spa salons, beauty salons used for the care of problematic, oily, sagging and aging skin;
- hairdressing is a good tonic essential oil for hair, it is considered an effective panacea for alopecia in men and women. Helps with dandruff, activates hair growth, is used to care for oily hair;
- massage salons used in massage or reflexology to correct the psycho-emotional state. Effective for nourishing aroma massage of the scalp.

Sanitation:

- meditation halls, yoga centers cedar oil calms well, relieves feelings of anxiety, so it is great for meditation;
- weight correction centers used in the treatment of obesity and accompanying cellulite;
- dermatology the oil disinfects the skin, eliminates inflammation and irritation of the skin. It is recommended for acne, dermatitis, eczema, against infectious, viral, mechanical damage to the skin, including in the fight against post-allergic manifestations, all types of burns.

Aromatherapy and aroma design: used to relieve tension, anxiety, anger, aggression and feelings of insecurity. Cedar oil has a calming effect, induces a feeling of comfort and is recommended for insomnia, premenstrual syndrome. Cedar is a fairly strong aphrodisiac that affects the sensual sphere almost as well as the emotional sphere: it removes discomfort and stiffness, and gives confidence. It is one of the best adaptogens for all occasions. It can be used by everyone who is prone to meteorological influences, desynchronosis, for adaptation when moving to other climatic zones. The aroma of cedar helps to create and opens a second breath, is used to increase efficiency [12-15, 34].

Orange essential oil (Figc. 1.2)



Fig. 1.2 Orange (a) and orange essential oil (b)

Orange essential oil (Oleum Citrus Sinensis) is an aromatic essential Orange essential oil (Oleum Citrus Sinensis) is an aromatic essential oil made from the peel of a sweet orange by cold pressing. Due to its rich composition and aromatherapeutic effect, it can be widely used in the perfumery, cosmetic and pharmaceutical industry, the beauty industry, specialized medical and wellness centers, massage salons, baths and saunas. High-quality essential oil of sweet orange does not contain preservatives, dyes and any chemical additives, it can be used as an ingredient of natural, organic cosmetics, perfumes or used as a natural flavoring oil, made from the peel of sweet orange by cold pressing method. Due to its rich composition and aromatherapeutic effect, it can be widely used in the perfumery, cosmetic and pharmaceutical industry, the beauty industry, specialized medical and wellness centers, massage salons, baths and saunas. High-quality sweet orange essential oil does not contain preservatives, dyes and any chemical additives, it can be used as an ingredient in natural, organic cosmetics, perfumes or used as a natural flavoring [26].

The characteristics of orange essential oil are given in the table 1.2.

Table 1.2

INCI:	Citrus Sinensis Peel Oil Expressed
Country of origin	Brazil
Method of production	Pressing the peel of a sweet orange (Citrus sinensis (L.) Pers.), Rutacea family, without heating
Appearance	Yellow, yellow-brown or orange colored liquid with a characteristic orange smell

Characteristics of orange essential oil

Fields of application of orange essential oil

In production:

• perfumes - the oil has a light, warm, sweet, spicy and refreshing orange smell;

- cosmetics for the production and enrichment of creams, balms, cosmetic oils, emulsions, lotions for the skin (restores and moisturizes the epidermis, softens the skin, protects against external negative influences), shampoos, balms, hair masks (helps fight) skin head), anti-aging (smooths out wrinkles, gives the skin elasticity and a healthy color) and anti-cellulite cosmetics, bath salts, soap (tones the skin);
- household products used for deodorizing candles, household chemicals (removes unwanted odors, for example, tobacco, persistent animal odor, disinfects the room).

In the beauty industry:

- Spa salons, beauty salons orange oil in cosmetology is used for skin care of all types, including normal and dry, especially keratinized;
- hairdressers care for normal and oily hair;
- massage salons used as part of massage mixtures, a very effective anti-cellulite agent, dissolves fat plaques in problem areas, makes the skin smooth, elastic and toned;
- solariums effectively eliminates peeling of the skin after sunbathing and helps to preserve the tan.

Sanitation:

- sports, gyms thanks to its active acids, it removes toxins and excess fluid from skin cells an order of magnitude faster than other similar substances;
- baths and saunas removes toxins, normalizes carbohydrate-fat metabolism;
- dermatology helps treat acne and dermatitis, cleans and tightens pores, removes post-acne scars.

Aromatherapy and aroma design: perfectly aromatizes the air in the premises, has a beneficial effect on the psycho-emotional state. It acts both soothingly and refreshingly, stabilizes the mood, helps to cope with stress, improves mood, instills confidence, invigorates, sets an optimistic mood, helps to cope with physical and emotional stress [8, 9, 28].

Chamomile essential oil (fig. 1.3)



Fig. 1.3 Medicinal chamomile (a) and chamomile essential oil (b)

Among all the variety of chamomile species, two types are mainly used as essential oils: German chamomile (synonyms: medicinal, pharmacy, blue, German, Hungarian) and Roman chamomile (synonyms: English, licorice).

Moroccan or wild chamomile (Ormenis multicaulis, Chamaemelum mixtum, Anthemis mixta) is also sometimes used.

Botanical name of German chamomile: Matricaria chamomilla, Matricaria recutita, Chamomilla recutita.

Botanical name of Roman chamomile: Anthemis nobilis, Chamaemelum nobile. Both plants are common in Europe. Cultivated mainly in Hungary, Belgium, France, Italy, Spain and the Balkans. Roman chamomile flowers are usually larger than German chamomile [14].

Despite the botanical affinity, the essential oils from these types of chamomile are radically different from each other in terms of their organoleptic indicators. The aroma of Roman chamomile essential oil is painted in pleasant floral-herbal tones with very tasty fruit shades (first of all, the aroma of an apple is guessed); the color is light blue or light yellow, with a high degree of transparency. The essential oil of German chamomile is dark blue, with blue or purple shades, viscous and almost opaque. Has a sharp balsamic-herbal aroma, much more medicinal and less familiar than Roman chamomile.

The color of German chamomile essential oil is due to its most valuable component called hamazulene (content - up to 15%), which is absent in the plant itself and is formed at high temperatures in the process of steam distillation from hamazulene carboxylic acid and its derivatives. With long-term storage, hamazulene oxidizes, and the color of the dark blue oil turns green and then brown. With such color changes, the oil loses its original therapeutic value. In such cases, it is no longer recommended to use it for aromatherapy.

The chemical composition of Roman chamomile essential oil is significantly different from that of German chamomile. Approximately 85% of it consists of esters of angelic acid. It contains much less hamazulene (usually no more than 1%) than German chamomile.

Three main properties of chamomile essential oil:

- A powerful sedative. Eliminates insomnia, normalizes sleep, making it calm and deep. Relieves anxiety, nervousness, irritability, overexcitement.
- It has a strong analgesic and antispasmodic effect. Helps with headaches and toothaches, migraines, muscle pains and spasms, arthritis, rheumatism, as well as digestive disorders, painful menstruation.
- An effective remedy for various skin diseases and lesions. It has a strong wound-healing and regenerating effect. It is recommended for use to relieve inflammation in burns, sunburns, and insect bites. Suitable for slow-healing wounds, open ulcers, abscesses, and infection caused by an ingrown nail. Effective in the treatment of eczema, urticaria, acne, as well as dry and itchy skin.

The versatility and mildness of chamomile essential oil is partially offset by a small disadvantage - its high cost.

For what health problems is it used:

- Nervous system: nervous disorders, overexcitement, stress, insomnia, headache, migraines.
- Digestive system: gastritis, diarrhea, flatulence, gastric and intestinal colic.
- Musculoskeletal system: muscle pain, arthritis, rheumatism.
- Reproductive and excretory systems: cystitis, vaginitis, prostatitis, PMS.
- Skin system: allergies, burns, cuts, blisters, psoriasis, eczema, herpes, insect bites.

Skin care: all skin types, but primarily dry, sensitive, prone to redness and itching, damaged skin.

Interesting facts about chamomile. Increasing the exposure of the plant to sunlight significantly improves the quality of the essential oil. The more light the plant receives, the more chamazulene will be in the composition of the essential oil.

Chamomile is called a plant doctor because it has a healing effect on surrounding plants.

Precautions. Do not use during the first trimester of pregnancy. Do not use against the background of homeopathic treatment, since chamomile essential oil cancels the effect of homeopathic drugs.

From the point of view of chemistry, it is surprising, but despite such serious differences in chemical composition, color and aroma, the properties of essential oils from two types of chamomile are very similar [5, 6, 17, 29].

Conclusions to chapter 1

1. An analysis of literary data was carried out regarding national and international recommendations for hygienic care of the skin of the hands of health care personnel and patients. There are instructions on hygienic treatment of hands, in particular, washing with detergents.

2. The perspective and expediency of using essential oils as a powerful antibacterial agent and a substitute for classical antiseptics are analyzed. In particular, the characteristics of essential oils of cedar, orange and chamomile are given.

CHAPTER 2

OBJECTS AND METHODS OF RESEARCH

2.1 Objects of research

When researching the domestic antibacterial soap market, the existing assortment was the object.

In the development of antibacterial soap with a complex of essential oils, APIs and auxiliary substances approved for use in medical and pharmaceutical practice were used.

<u>Coconut oil (SPU 1.2, p. 470 – 471)</u> – oily mass of white or almost white color with a characteristic coconut smell. Practically not soluble in water, easily soluble in methylene chloride and petroleum ether, very slightly soluble in 96% alcohol, soluble in hydrophobic solvents. Melting point (23.0 – 26.0) °C, acid value no more than 0.50, peroxide value no more than 5.0, unsaponifiable matter no more than 1.0%.

<u>Olive oil (EP, 01/2005:0518, p. 2136)</u> – extra virgin olive oil is a fatty oil obtained by cold pressing or other suitable mechanical means from the ripe pits of Olea europaea L. A clear, yellow or greenish-yellow transparent liquid with a characteristic odor, practically insoluble in alcohol, miscible with gasoline (50 °C up to 70 °C).

<u>Purified water (SPU 1.0, p. 308 - 309)</u> – colorless, transparent, odorless and tasteless liquid, pH 5.0 - 7.0. It was used as a solvent.

<u>Sodium hydroxide (SPU 1.1, p. 411)</u> – white crystalline mass in the form of granules, sticks or plates. Dissolves in air, easily absorbs carbon dioxide from the air. Very easily soluble in water P, easily soluble in 96% alcohol P.

<u>Cedar essential oil (CAS Registry Number: 8000-27-9)</u> – viscous liquid from light yellow to pale brown in color; sometimes hardens at room temperature; has a characteristic smell.

<u>Orange essential oil (CAS Number: 8008-57-9)</u> – the oil has a fruity, sweet smell. It has a yellowish tint. Orange ether contains a large amount of vitamins A, C and B, as well as lemon and citral, which have an antioxidant effect.

<u>Chamomile essential oil (BP, Vol. 3, p.1, Ph Eur monograph 1836)</u> – blue essential oil obtained by steam distillation from fresh or dried flower heads or flowering tops of Matricaria recutita L. (Chamomilla recutita L. Rauschert). There are 2 species of matricaria that are characterized as rich in bisabolol oxides or rich in (-)- α -bisabolol.

All substances used met the requirements of the relevant regulatory documentation [3, 7, 18, 23, 24].

2.2 Methods of research

The cost price was determined using well-known mathematical methods.

<u>Statistical analysis of the research</u> results was carried out in accordance with the requirements of DFU 2.1, section 5.3 using methods of statistical and mathematical analysis [31, 35, 36].

Conclusions to chapter 2

1. The properties of the research objects, in particular, the active pharmaceutical ingredients (essential oils of cedar, orange, and chamomile) and auxiliary substances (purified water, sodium hydroxide, olive oil, and coconut oil) used in the experimental part are described.

2. The methods and conditions of conducting economic, physico-chemical, pharmacotechnological tests, which were used in studying the properties of the received soap samples, were selected and described.

CHAPTER 3

DEVELOPMENT OF THE COMPOSITION OF ANTI-BACTERIAL SOAP BASED ON A COMPLEX OF ESSENTIAL OILS

3.1 Study of the range of the domestic market of soap with an antibacterial effect

According to the website <u>https://markakachestva.ru/</u>, the rating of antibacterial soap was made up of the following products:

- 1. Dettol Reliable protection against bacteria
- 2. Safeguard Prolonged action
- 3. Absolut Gentle cleansing

Dettol (fig. 3.1)

Purpose:antibacterialsoap,aromatization, moisturizing, cleaningApplication time:universalClassification:mass marketCountry of TM:Great BritainMade in:Poland

Safeguard (fig. 3.2) Purpose: antibacterial, cleaning Application time: universal Classification: mass market Country of TM: USA Made in: China



Fig. 3.1 Antibacterial soap Dettol



Fig. 3.2 Antibacterial soap Safeguard

<u>Absolut (fig. 3.3)</u> Purpose: antibacterial, cleaning Application time: universal Classification: mass market TM country: RF Made in: RF



Fig. 3.3 Antibacterial soap Absolut

The price variability (according to the website <u>https://pn.com.ua/</u>) for the specified products is shown in the table 3.1.

Table 3.1

Fluctuations in price offers for antibacterial soap of selected brands

Antibacterial soan	Price fluctua	ations, UAH	Quantity of offers	
r miloueteriur soup	min	max	Quantity of offolio	
Dettol	92.0	92.0	1	
Safeguard	15.0 (for 90 g)	67.0	116	
Absolut	-	-	-	

The determined price indicators will be used for a comparative assessment with the cost price of the antibacterial soap being developed.

3.2 Justification of the composition of antibacterial soap with a complex of essential oils

Cedar oil is a unique essence that has been used by people since ancient Egypt. Cedar is mentioned in ancient manuscripts, where it is called a symbol of abundance and fertility. There is talk about a wonderful tree in the Old Testament. Noah's ark was built from gopher (that's what cedar was called in ancient times). The wood was used for making sarcophagi, building palaces and temples.

At the end of the 18th century, the healing properties of cedar essential oil were noted. Modern research has confirmed the claims of doctors of the past.

Like all representatives of the Conifer family, cedar essential oil has powerful antiseptic and antiviral properties. The properties of cedar essential oil and its use depend on the chemical composition of the substance. Researchers single out a large group of alcohols of the class of terpenes (cedrol), turpentine hydrocarbons (cadinene); trace elements and vitamins (more of them are contained in nut oil, but they are also present in essential oil).

Cedar essential oil has an effective anti-inflammatory, hormone-regulating, diuretic, analgesic effect, eliminates tremors and nervous tremors, promotes quick and effective wound healing and skin recovery after injuries, improves blood circulation and increases work capacity.

It is also effective in the composition of hair care products with a pronounced preventive effect (prevention of dandruff and hair loss).

Nevertheless, this essential oil has certain application features. When applied directly to the skin, cedar essential oil usually causes a mild burning sensation. There is practically no allergic reaction of the skin to it, but individual intolerance to the smell may appear a few minutes after application.

Also, it cannot be taken simultaneously with alcohol, during a course of chemotherapy, and by pregnant women.

Since cedar essential oil stimulates performance and increases activity, it cannot be used in hyperactive states and increased anxiety.

Pine nut oil acts as a wound-healing and bactericidal agent for the skin. Thanks to the large amount of vitamin E in the composition of the oil, the vitamin of youth, the skin products perfectly remove dryness and peeling, making the skin elastic and shiny. Small wrinkles will simply disappear after a few applications of the cosmetic product with the miraculous oil of delicious walnut.

It is known that the essential oils presented on the market have additional labeling indicating their composition and method of production [10, 21, 22].

The global standardization system ISO (International Organization for Standardization) gives the following definition of essential oils:

• 100% natural – oil essence that does not contain any synthetic additives, emulsifying agents, mineral oils, etc.;

• 100% pure (pure) – essential oils that do not contain any other oil essences added to this product. For example, if it is lavender oil, then no other types of lavender oil (such as lavandin) are included in it;

• 100% complete (complete) - oil essence that has not undergone special processing, patience has not been removed from it, or it has not been subjected to appropriate purification, etc.

As additional labeling of essential oils, information on the method of their production or the type of extractant is also indicated:

- extra means that the essential oil has undergone only 1 round of distillation, while usually plant raw materials undergo distillation 4 times;
- complete a mixture obtained after the raw material was subjected to distillation 4 times;
- CO2 extract essential oil obtained with the help of liquid carbon dioxide; absolute essential oil obtained using volatile solvents;
- therapeutic grade essential oil, which is used in the production of medicinal products (usually such oils are covered by articles in the pharmacopoeia of different countries).

Therefore, in order to determine the exact type of cedar oil for introduction into the soap base, we studied the offers of the pharmaceutical market of Ukraine in the position "cedar essential oil".

The assortment of cedar essential oil on the market is mostly represented by the type of natural oil. At the same time, there are often no regulatory documents or documents confirming the authenticity of the oil.

Among the offers of cedar oil, which has the appropriate accompanying documentation (quality certificate, analytical sheet, etc.), CO2 type samples (table 3.2) and therapeutic grade (table 3.3) were found on the market.

Botanical name:	Cedrus deodora
CAS #	8000-27-9
Country of Origin	India
Description	Viscous liquid from light yellow to pale brown
	in color with a cedar smell
Solubility	Soluble in alcohol and oil, insoluble in water
Specific weight	0.949-0.961 @ 20 °C
Optical rotation	(-25°) - (-37°)
Refractive index	1.5030 – 1.5067 @ 20°C
Flash point	>100°C
Storage conditions	Store in a tightly closed, preferably full,
	container. Protect from heat and light.
Storage temperature	10°C - 32°C
Type of extraction	Supercritical CO ₂ extraction

CO₂ quality indicators of cedar essential oil

Atlas cedar and Himalayan cedar have been found to be the safest for therapeutic use, have a more balsamic aroma, and are the only true cedars commonly available. Texas cedar and Virginia cedar are actually junipers and, while quite useful, differ in aroma and therapeutic value. Additionally, cedar leaf oil (Thuja occidentalis, also known as American thuja, eastern thuja, eastern white cedar, swamp cedar, or northern white cedar) comes from a type of cypress tree that should be used very carefully or not at all because of its toxicity. [11, 16, 19, 20].

30

Botanical name:	Cedrus deodora		
CAS #	8000-27-9		
Country of Origin	CIIIA, Healing Solutions		
Description	Viscous liquid from light yellow to pale brown		
	in color with a cedar smell		
Solubility	Soluble in alcohol and oil, insoluble in water		
Specific weight	0.949-0.961 @ 20 °C		
Optical rotation	(-25°) - (-37°)		
Refractive index	1.5030 – 1.5067 @ 20°C		
Flash point	>100°C		
Storage conditions	Store in a tightly closed, preferably full,		
	container. Protect from heat and light.		
Storage temperature	10°C - 32°C		
Type of extraction	100% Pure Cedarwood Essential Oil,		
	Therapeutic Grade, Distilled		

Quality indicators of therapeutic grade cedar essential oil

When processing literary sources, it was established that the use of cedar essential oil is limited due to its high volatility and poor solubility in water. To solve this problem, the authors prepared two types of oil-in-water cedar essential oil emulsions, including cedar essential oil nanoemulsion (CEO-NE) and cedar pickering essential oil emulsion (CEO-PE). CEO-NE with 5% surfactant had a smaller particle size (135.14 \pm 1.1 nm) and a higher absolute zeta potential (32.75 mV) compared to CEO-PE (1% starch), whose particle size was 626.21 \pm 6.05 nm, zeta potential was 27.58 mV. The stability of CEO-NE and CEO-PE was tested by multiple light scattering, and the results showed that the turbiscan stability index (TSI) value of CEO-NE was much lower than that of CEO-PE. CEO-NE and CEO-PE exhibited higher free radical scavenging activity, iron-reducing power, and

antibacterial ability than CEO itself. These results indicate that emulsification is a feasible method to expand the application of CEO [21].

So, on the basis of the conducted research, it was established that for the further development of soap with an antibacterial effect, it is advisable to use the essential oil of the Atlas or Himalayan cedar, type therapeutic grade [32, 33].

It is known that essential oil of cedar belongs to oils with low volatility. Possible options for combining cedar essential oil with other oils [10] are described in table 3.4.

Table 3.4

Essential oil	Сумісність та леткість інших ефірних олій		
	highly volatile	orange, bergamot, clary sage	
Cedar essential oil (low	middle volatile	cypress, juniper, chamomile, pine,	
volatility)		black pepper	
	low volatile	jasmine, ginger	

Compatibility of cedar essential oil

The classic scheme of preparing an aromatic composition involves mixing essential oils with different volatility in equal proportions.

In order to strengthen the antibacterial effect of the soap we are developing, it is advisable to add essential oils of chamomile and orange to the essential oil of cedar. The combination of selected essential oils will provide a powerful antibacterial effect, as well as have reparative and healing properties.

After processing the data of the scientific literature and recommendations for the preparation of medical and cosmetic products, we proposed the following composition of soap with an antibacterial effect based on API of natural origin (table 3.5). The composition of soap with an antibacterial effect is based on API of natural origin

Ingredient	Quantity, g
Coconut oil	13.5
Olive oil	52.0
Purified water (cooled)	24 ml
Sodium hydroxide	9.0
Cedarwood essential oil	0.5
Chamomile essential oil	0.5
Orange essential oil	0.5
Totally:	100.0

3.3. Justification of the technology for the production of antibacterial soap with a complex of essential oils

The development of laboratory technology for the production of soap with a complex of essential oils was carried out in accordance with the requirements of the current legislation and guidelines for the preparation of medical and cosmetic products [26, 30, 37].

The work was carried out under a fume cupboard.

Illustrations of the manufacturing process of antibacterial soap are shown in fig. 3.4 a-d.

Stage 1. Purified water is cooled to a temperature of 8.0 ± 2.0 °C and sodium hydroxide is carefully added. Mix thoroughly and leave to cool to a temperature of 36 ± 2.0 °C (the process of dissolving sodium hydroxide is accompanied by heating, so it will take time to cool).

Stage 2. Melt coconut oil at a temperature of 45.0 ± 2.0 °C, add olive oil. Cool to a temperature of 36 ± 2.0 °C.

Stage 3. When both mixtures have reached the same temperature $(36\pm2.0^{\circ}$ C), the aqueous and oil phases are mixed (sodium hydroxide solution is carefully

poured into the mixture of oils, mixed with a homogenizer until homogeneous). Carefully add essential oils of cedar, chamomile and orange.

Stage 4. The resulting soap mass is poured into a silicone mold prelubricated with 96% ethanol and covered with cling film. The form with the soap mass is left at room temperature for 12 hours. Then the film is removed, the finished soap is removed from the mold and left to dry for 1 hour.

The resulting soap is placed in a dry place for 2-4 weeks to mature.



Fig. 3.4 The technological process of manufacturing antibacterial soap according to the developed composition: a – introduction of sodium hydroxide to cooled purified water; b – melting coconut oil; c – introduction of essential oils; d – pouring soap mass into a silicone mold

3.4. Calculation of the cost of antibacterial soap with a complex of essential oils

According to the chosen composition of the mask, the number of necessary ingredients and their cost on the Ukrainian market were calculated (based on the data of the website https://medbrowse.com.ua).

The composition of the finished soap with a mass of 100.0 was calculated (table 3.6) [25, 36, 37].

Table 3.6

origin* Ingredient Average cost, UAH Quantity, g Coconut oil 13.5 52.20 Olive oil 52.0 66.90 Purified water (cooled) 24 ml 0.24 Sodium hydroxide 9.0 0.73 Cedarwood essential oil 0.5 2.78 Chamomile essential oil 0.5 58.55 12.0 Orange essential oil 0.5 Totally: 100.0 193.4

The cost of soap with an antibacterial effect based on API of natural

Note. * The cost of each component of the soap was calculated according to the price offer for the substance in the leading sales networks and without the cost of the manufacturing tariff.

That is, according to the calculations, the cost of 100.0 antibacterial soap of the developed composition will be about UAH 193.4.

Conclusions to chapter 3

1. The domestic assortment of antibacterial soap was studied. According to the data of 2021, it was found that the best indicators have the trademarks Dettol (reliable protection against bacteria), Safeguard (prolonged effect) and Absolut (gentle cleaning). Price ranges from UAH 15 to UAH 92 have been set for these positions. There is no brand of Absolut antibacterial soap produced in the RF on the market.

2. Studies of the properties of different types of essential cedar oil have established that for the further development of soap with an antibacterial effect, it is advisable to use essential oil of the Atlas or Himalayan cedar, therapeutic grade.

3. Based on the analysis of data from the scientific literature on the combination of essential oils, the final composition of antibacterial soap was developed based on the essential oils of cedar, orange and chamomile.

4. For a sample of antibacterial soap of the developed composition, the cost price was calculated, which amounted to UAH 193.4 per 100.0 g.

GENERAL CONCLUSIONS

1. Literary sources on national and international recommendations for hygienic care of the skin of the hands, both for the general population and for health care workers, were analyzed. Instructions for hygienic hand treatment, in particular, washing with detergents, are given. The prospective use of essential oils of cedar, orange and chamomile as an antibacterial agent, which is not addictive and can act as an alternative to known antibacterial components of synthetic origin, was evaluated.

2. The characteristics of objects (essential oils of cedar, orange, chamomile, (purified water, sodium hydroxide, olive oil and coconut oil)) and research methods used in the experimental part are given.

3. The antibacterial soap market was analyzed. It was found that according to the data of 2021, the best indicators in the rating of consumer characteristics are the trademarks of Dettol (reliable protection against bacteria), Safeguard (prolonged effect) and Absolut (gentle cleaning). There is no brand of Absolut antibacterial soap produced in the Russian Federation on the market. Price offers for Dettol and Safeguard range from UAH 15 to UAH 92.

4. When developing the composition of antibacterial soap based on a complex of essential oils, data from the analysis of domestic and literary sources were taken into account. It has been established that it is advisable to use essential oil of the Atlas or Himalayan cedar, of the therapeutic grade type. To enhance the antibacterial effect, cedar essential oil should be combined with chamomile and orange essential oils.

5. The cost price of a sample of antibacterial soap of the developed composition was UAH 193.4 per 100.0 g.

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Appendixes

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dedicated to the 60th anniversary of the birth of Doctor of Pharmaceutical Sciences, Professor Gladukh levgenii Volodymyrovych

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ALLEBTH

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присвяченої 60-річчно з дня народження доктора фармацевтичних наух, прядресора Гладуха Євгенія Володимировича

Мау 10-11, 2023, Кharkiv, Ukraine 10-11 травня 2023 року, Харкія, Україна

Rector of the NUPh, prof. Pekrop Hoay, npod.

Head of the Department of Technologies of Pharmaceutical preparations, prof.

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Олександр КУХТЕНКО



44

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ НАЦІОНАЛЬНА АКАДЕМІЯ НАУК ВИЩОЇ ОСВІТИ УКРАЇНИ КАФЕДРА ТЕХНОЛОГІЙ ФАРМАЦЕВТИЧНИХ ПРЕПАРАТІВ

MINISTRY OF HEALTH OF UKRAINE MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE NATIONAL UNIVERSITY OF PHARMACY NATIONAL ACADEMY OF HIGHER EDUCATION SCIENCES OF UKRAINE DEPARTMENT OF TECHNOLOGIES OF PHARMACEUTICAL PREPARATIONS

> х міжнародна науково-практична конференція «СУЧАСНІ ДОСЯГНЕННЯ ФАРМАЦЕВТИЧНОЇ

ТЕХНОЛОГІЇ»

присвячена 60-річчю з дня народження доктора фармацевтичних наук, професора Гладуха Євгенія Володимировича

X INTERNATIONAL SCIENTIFIC-PRACTICAL CONFERENCE

«MODERN ACHIEVEMENTS OF PHARMACEUTICAL TECHNOLOGY»

dedicated to the 60th anniversary of the birth of Doctor of Pharmaceutical Sciences, Professor Gladukh levgenii Volodymyrovych

> ЗБІРНИК НАУКОВИХ ПРАЦЬ COLLECTION OF SCIENTIFIC WORKS

> > XAPKIB KHARKIV

> > > 2023

Appendix B

45

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ НАЦІОНАЛЬНА АКАДЕМІЯ НАУК ВИЩОЇ ОСВІТИ УКРАЇНИ КАФЕДРА ТЕХНОЛОГІЙ ФАРМАЦЕВТИЧНИХ ПРЕПАРАТІВ

MINISTRY OF HEALTH OF UKRAINE MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE NATIONAL UNIVERSITY OF PHARMACY NATIONAL ACADEMY OF HIGHER EDUCATION SCIENCES OF UKRAINE DEPARTMENT OF TECHNOLOGIES OF PHARMACEUTICAL PREPARATIONS

Х МІЖНАРОДНА НАУКОВО-ПРАКТИЧНА КОНФЕРЕНЦІЯ «СУЧАСНІ ДОСЯГНЕННЯ ФАРМАЦЕВТИЧНОЇ ТЕХНОЛОГІЇ»

присвячена 60-річчю з дня народження

доктора фармацевтичних наук,

професора Гладуха Євгенія Володимировича

X INTERNATIONAL SCIENTIFIC-PRACTICAL CONFERENCE «MODERN ACHIEVEMENTS OF PHARMACEUTICAL

TECHNOLOGY»

dedicated to the 60th anniversary of the birth of Doctor of Pharmaceutical Sciences, Professor Gladukh Ievgenii Volodymyrovych

> ЗБІРНИК НАУКОВИХ ПРАЦЬ COLLECTION OF SCIENTIFIC WORKS

> > XAPKIB KHARKIV 2023

УДК: 615.1

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Редакційна колегія:

проф. Котвіцька А.А., проф. Владимирова І.М., проф. Кухтенко О.С., доц. Солдатов Д.П.

Сучасні досягнення фармацевтичної технології : матеріали X міжнар. наук.-практ. конф., присвяч. 60-річчю з дня народж. д-ра фармацевт. наук, проф. Гладуха Євгенія Володимировича, м. Харків, 10-11 трав. 2023 р. – Харків : НФаУ, 2023. – 292 с.

Modern achievements of pharmaceutical technology : Collection of X International Scientific-Practical Conference, dedicated to the 60th anniversary of the birth of Doctor of Pharmaceutical Sciences, Professor Gladukh Ievgenii Volodymyrovych, Kharkiv, May 10-11, 2023. – Kharkiv : NUPh, 2023. – 292 p.

Збірник містить матеріали X Міжнародної науково-практичної конференції «Сучасні досягнення фармацевтичної технології», присвяченої 60-річчю з дня народження доктора фармацевтичних наук, професора Гладуха Євгенія Володимировича (10-11 травня 2023, м. Харків).

Розглянуто теоретичні та практичні аспекти розробки, виробництва, перспективи створення, контролю якості, стандартизації та реалізації лікарських засобів природного, синтетичного та біотехнологічного походження на сучасному етапі у промислових умовах та екстемпоральних лікарських засобів, питання підготовки здобувачів вищої освіти за освітніми програмами «Фармація», «Технології фармацевтичних препаратів», «Біотехнологія», «Промислова біотехнологія», «Фармацевтична біотехнологія» тощо.

Для широкого кола науковців, співробітників фармацевтичних та біотехнологічних підприємств, науково-дослідних установ, фармацевтичних фірм, науково-педагогічних працівників закладів вищої освіти.

Collection contains materials of the X International Scientific-Practical Internet-Conference «Modern achievements of pharmaceutical technology» dedicated to the 60th anniversary of the birth of Doctor of Pharmaceutical Sciences, Professor Gladukh Ievgenii Volodymyrovych (May 10-11, 2023, Kharkiv).

Theoretical and practical aspects of development, production, prospects of creation, quality control, standardization and realization of medicines of natural, synthetic and biotechnological origin at the present stage in industrial conditions and extemporaneous medicines, questions of preparation of applicants for higher education on educational programs "Pharmacy", "Technologies of pharmaceuticals", "Biotechnology", "Industrial biotechnology" and "Pharmaceutical biotechnology", etc are considered.

For a wide range of scientists, employees of pharmaceutical and biotechnological enterprises, research institutions, pharmaceutical companies, teachers of higher education institutions.

Редколегія не завжди поділяє погляди авторів статей. Автори опублікованих матеріалів несуть повну відповідальність за підбір, точність наведених фактів, цитат, отриманих даних, висновків, власних імен та інших відомостей. Матеріали подаються мовою оригіналу.

47

«Сучасні досягнення фармацевтичної технології» (10-11 травня 2023 р., м. Харків)

SUBSTANTIATION OF THE COMPOSITION OF ANTI-BACTERIAL SOAP WITH A COMPLEX OF ESSENTIAL OILS Semchenko Kateryna, El Amrani Houda National University of Pharmacy, Kharkiv, Ukraine

Introduction. In modern conditions of the spread of respiratory diseases, hand hygiene requires a responsible approach from both medical and pharmacy workers and patients. Compared to ordinary soap, antibacterial soap has many advantages as a reliable barrier to the entry of pathogens of viral and infectious diseases.

The aim of the study. The aim of our work is to develop an antibacterial soap based on ingredients of natural origin, where the active pharmaceutical ingredients are a mixture of essential oils of cedar, chamomile, and orange.

Methods of research. The research used methods of analysis and generalization of scientific literature data.

Main results. Cedar oil is a unique essence that has been used by people since ancient Egypt. Cedar is mentioned in ancient manuscripts, where it is called a symbol of abundance and fertility. There is talk about a wonderful tree in the Old Testament. Noah's ark was built from gopher (that's what cedar was called in ancient times). The wood was used for making sarcophagi, building palaces and temples.

Like all representatives of the Conifer family, cedar essential oil has powerful antiseptic and antiviral properties. The properties of cedar essential oil and its use depend on the chemical composition of the substance. Researchers single out a large group of alcohols of the class of terpenes (cedrol), turpentine hydrocarbons (cadinene); trace elements and vitamins (more of them are contained in nut oil, but they are also present in essential oil).

Cedar essential oil has an effective anti-inflammatory, hormone-regulating, diuretic, analgesic effect, eliminates tremors and nervous tremors, promotes quick and effective wound healing and skin recovery after injuries, improves blood circulation and increases work capacity.

Nevertheless, this essential oil has certain application features. When applied directly to the skin, cedar essential oil usually causes a mild burning sensation. There is practically no allergic reaction of the skin to it, but individual intolerance to the smell may appear a few minutes after application.

Also, it cannot be taken simultaneously with alcohol, during a course of chemotherapy and by pregnant women. Since cedar essential oil stimulates performance and increases activity, it cannot be used in hyperactive states and increased anxiety.

Cedar essential oil acts as a wound-healing and bactericidal agent for the skin. Thanks to the large amount of vitamin E in the composition of the oil, the vitamin of youth, the skin products perfectly remove dryness and peeling, making the skin elastic and shiny. Small wrinkles will simply disappear after a few applications of the cosmetic product with the miraculous oil of delicious walnut.

When processing literary sources, it was established that the use of cedar essential oil is limited due to its high volatility and poor solubility in water. To solve this problem, the authors prepared two types of oil-in-water cedar essential oil emulsions, including cedar essential oil nanoemulsion (CEO-NE) and cedar pickering «Сучасні досягнення фармацевтичної технології» (10-11 травня 2023 р., м. Харків)

essential oil emulsion (CEO-PE). CEO-NE with 5% surfactant had a smaller particle size (135.14 \pm 1.1 nm) and a higher absolute zeta potential (32.75 mV) compared to CEO-PE (1% starch), whose particle size was 626.21 \pm 6.05 nm, zeta potential was 27.58 mV. The stability of CEO-NE and CEO-PE was tested by multiple light scattering, and the results showed that the turbiscan stability index (TSI) value of CEO-NE was much lower than that of CEO-PE. CEO-NE and CEO-PE exhibited higher free radical scavenging activity, iron-reducing power, and antibacterial ability than CEO itself. These results indicate that emulsification is a feasible method to expand the application of CEO.

So, on the basis of the conducted research, it was established that for the further development of soap with an antibacterial effect, it is advisable to use the essential oil of the Atlas or Himalayan cedar, of the therapeutic grade type.

It is known that essential oil of cedar belongs to oils with low volatility. Possible combinations of cedar essential oil with other oils are described in table 1.

Table 1

Essential oil	Compatibility and volatility of other essential oils		
	highly volatile	orange, bergamot, clary sage	
Cedar essential oil	medium volatile	cypress, juniper, chamomile, pine, black pepper	
	low volatile	jasmine, ginger	

Compatibility of essential oil of cedar

The classic scheme of preparing an aromatic composition involves mixing essential oils with different volatility in equal proportions. In order to strengthen the antibacterial effect of the soap, it is advisable to add essential oils of chamomile and orange to the essential oil of cedar. The combination of selected essential oils will provide a powerful antibacterial effect, as well as have reparative and wound-healing properties.

After processing data from scientific literature and recommendations for the preparation of medical and cosmetic products, we suggest the following composition of soap with an antibacterial effect based on API of natural origin (table 2).

Table 2

Composition of some	
Ingredient	Quantity, g
Coconut oil	13.5
Olive oil	52.0
Purified water	24 ml
Sodium hydroxide	9.0
Cedar essential oil	0.5
Chamomile essential oil	0.5
Orange essential oil	0.5
Totally:	100.0

Composition of soap with an antibacterial effect

Conclusions. On the basis of the conducted research composition of soap with an antibacterial effect is based on API of natural origin was substantiated.

National University of Pharmacy

Faculty <u>for foreign citizens' education</u> Department <u>pharmaceutical technology of drugs</u>

Level of higher education master

Specialty <u>226 Pharmacy</u>, industrial pharmacy Educational program <u>Pharmacy</u>

> APPROVED The Head of pharmaceutical technology of drugs Department

Liliia VYSHNEVSKA <u>"_28_"_September_2022</u>

ASSIGNMENT FOR QUALIFICATION WORK OF AN APPLICANT FOR HIGHER EDUCATION

Houda EL AMRAINI

1. Topic of qualification work: «Development of the composition of antibacterial soap with a complex of essential oils», <u>supervisor of qualification work: Kateryna SEMCHENKO, Doctor of</u> Pharmacy, assoc. prof.

approved by order of NUPh from <u>"6st" of February 2023 № 35</u>

2. Deadline for submission of qualification work by the applicant for higher education: <u>April</u> 2023.

3. Outgoing data for qualification work: <u>the work is devoted to the development the composition</u> <u>of antibacterial soap on the basis of the complex of essential oils.</u>

4. Contents of the settlement and explanatory note (list of questions that need to be developed):
to study modern recommendations for hygienic treatment of hands;

to analyze the range of products in the form of soap with antibacterial properties;

to develop the composition of antibacterial soap with a complex of essential oils;

to justify the technology of manufacturing soap of the proposed composition.

5. List of graphic material (with exact indication of the required drawings): Tables – 8, figures – 7

6. Consultants of chapters of qualification work

Chapters	Name, SURNAME, position of consultant	Signature, date	
		assignment was issued	assignment was received
1	Kateryna SEMCHENKO, associate professor of higher education institution of pharmaceutical technology of drugs department	28.09.2022	28.09.2022
2	Kateryna SEMCHENKO, associate professor of higher education institution of pharmaceutical technology of drugs department	17.11.2022	17.11.2022
3	Kateryna SEMCHENKO, associate professor of higher education institution of pharmaceutical technology of drugs department	19.12.2022	19.12.2022

7. Date of issue of the assignment: <u>«28» September 2022</u>

CALENDAR PLAN

№ 3/п	Name of stages of qualification work	Deadline for the stages of qualification work	Notes
1	Topic selection	September 2022	done
2	Literature data analysis	October 2022	done
3	Conducting experimental research	October-December 2022	done
4	Work design	January-March 2023	done
5	Submission of finished work to the commission	April 2023	done

An applicant of higher education

_____ Houda EL AMRAINI

Supervisor of qualification work

_____ Kateryna SEMCHENKO

ВИТЯГ З НАКАЗУ № 35 По Національному фармацевтичному університету від 06 лютого 2023 року

нижченаведеним студентам 5-го курсу 2022-2023 навчального року, навчання за освітнім ступенем «магістр», галузь знань 22 охорона здоров'я, спеціальності 226 – фармація, промислова фармація, освітня програма – фармація, денна форма здобуття освіти (термін навчання 4 роки 10 місяців та 3 роки 10 місяців), які навчаються за контрактом. затвердити теми кваліфікаційних робіт:

Прізвище студента	Тема кваліфікаційної роботи		Посада, прізвище та ініціали керівника	Рецензент кваліфікаційної роботи
• по кас	федрі аптечної техн	ології ліків		
Ель Амрані Худа	Розробка складу антибактеріального мила з комплексом ефірних олій	Development of the composition of antibacterial soap with a complex of essential oils	доц. Семченко К. В.	доц. Буряк М. В.

Підстава: подання декана, тола ректора

Ректор

Факультет підготовки

Вірно. Секрет

ВИСНОВОК

Комісії з академічної доброчесності про проведену експертизу щодо академічного плагіату у кваліфікаційній роботі здобувача вищої освіти

№ 112323 від «17 » квітня 2023 р.

Проаналізувавши випускну кваліфікаційну роботу за магістерським рівнем здобувача вищої освіти денної форми навчання Ель Амрані Худа, ^{Фм18(5,0д)} 5 курсу, <u>англ-06</u> групи, спеціальності 226 Фармація, промислова фармація, на тему: «Розробка складу антибактеріального мила з комплексом ефірних олій / Development of the composition of antibacterial soap with a complex of essential oils», Комісія з академічної доброчесності дійшла висновку, що робота, представлена до Екзаменаційної комісії для захисту, виконана самостійно і не містить елементів академічного плагіату (компіляції).

Голова комісії, професор

Am

Інна ВЛАДИМИРОВА

2% 25%

REVIEW

of scientific supervisor for the qualification work of the master's level of higher education of the specialty 226 Pharmacy, industrial pharmacy

Houda EL AMRAINI

on the topic: «Development of the composition of antibacterial soap with a complex of essential oils»

Relevance of the topic.

Hygiene has always been one of the relevant topics. Basically, the current level on respiratory diseases is extremely high. The frequency of SARS, influenza and COVID leaves no doubt in the urgent search of effective and safe method for hand washing. The existing range of antibacterial soaps in Ukraine do not meet the demands of the customers and show quite low level of safety due to the active use of synthetic antibacterial agent. Thus, the development of new domestic soap based on the active pharmaceutical ingredients of natural origin is relevant and timely task of the modern Ukrainian pharmaceutical science.

Practical value of conclusions, recommendations and their validity.

The practical value of the work is based on the study of physical and chemical, pharmaco-technological, economical and statistical studies of essential oils and samples of the soap obtained on their basis. The author successfully justified the composition and technology of antibacterial soap with a complex of essential oils. The calculated cost of the soap proved that it is a compatible remedy on the field of antibacterial soaps in Ukraine.

Assessment of work.

The successful solution of tasks enabled the author of the qualification work to achieve the goal and obtain practical and theoretical results. The work was done at a sufficient scientific level, which indicates the author's ability to work with literary sources, analyze, systematize and generalize the experimental data obtained.

General conclusion and recommendations on admission to defend.

The qualification work of Houda EL AMRAINI meets all the requirements for qualification works and can be presented for the defense at the Examination Commission of the National University of Pharmacy.

Scientific supervisor

_____ Kateryna SEMCHENKO

«12» April 2023

REVIEW

for qualification work of the master's level of higher education, specialty 226 Pharmacy, industrial pharmacy

Houda EL AMRAINI

on the topic: «Development of the composition of antibacterial soap with a complex of essential oils»

Relevance of the topic.

Nowadays, hand hygiene requires a responsible approach from both medical and pharmaceutical workers and patients due to the spread of respiratory diseases. Compared to ordinary soap, antibacterial soap has many advantages as a reliable barrier to the entry of pathogens of viral and infectious diseases. On the other hand, the constant use of antiseptics leads to a violation of the natural microbiological balance of the skin and the habituation of the pathogenic microflora to the antibacterial agent. Therefore, it is extremely important to use products of natural origin, namely essential oils, to treat the skin of the hands to ensure a powerful antibacterial effect with minimal damage to the natural microflora of the hands and the absence of the problem of habituation among pathogens.

Theoretical level of work.

The applicant for higher education conducted analysis of modern scientific literature about approaches of hand hygiene and prospects of diverse essential oils usage. The experimental part included justification of composition of essential oils and soap samples on their basis as well as extemporal technology of preparation. The author conducted the economic research in the direction of approximate cost calculation of 100.0 g of the soap to determine competitiveness of the developed soap.

The author's suggestions on the topic of research.

It was determined that it is advisable to use essential oil of the Atlas or Himalayan cedar, of the therapeutic grade type. To enhance the antibacterial effect, cedar

essential oil should be combined with chamomile and orange essential oils. The laboratory technology of preparation is justified and described.

Practical value of conclusions, recommendations and their validity.

A medicinal and cosmetic product with an antibacterial effect based on a complex of essential oils of cedar, chamomile and orange in the form of soap is offered.

Disadvantages of work.

There are incorrect expressions and grammatical errors in the work.

General conclusion and assessment of the work.

The qualification work of Houda EL AMRAINI based on the results of research and volume of the experiment performed can be presented for the defense at the Examination Commission of the National University of Pharmacy.

Reviewer	 assoc. prof. Marina BURYAK
«19» April 2023	

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ

ВИТЯГ З ПРОТОКОЛУ № _9_

«<u>26</u>» <u>квітня 2023</u> року м. Харків

засідання кафедри _____аптечної технології ліків ______ (назва кафедри)

Голова: завідувачка кафедри, професор Вишневська Л.І. Секретар: докт. філ., асистент Коноваленко І. С.

ПРИСУТНІ:

Богуцька О. Є., Зуйкіна С. С., Ковальова Т. М., Крюкова А. І., Марченко М. В., Половко Н. П., Семченко К. В.

ПОРЯДОК ДЕННИЙ:

1. Про представлення до захисту кваліфікаційних робіт здобувачів вищої освіти.

СЛУХАЛИ: проф. Вишневську Л. I. – про представлення до захисту до Екзаменаційної комісії кваліфікаційних робіт здобувачів вищої освіти.

ВИСТУПИЛИ: Здобувач вищої освіти групи Фм18(5,0д)-англ 06 спеціальності 226 Фармація, промислова фармація Худа ЕЛЬ АМРАНІ – з доповіддю на тему «Розробка складу антибактеріального мила з комплексом ефірних олій/Development of the composition of antibacterial soap with a complex of essential oil» (науковий керівник доц. Катерина СЕМЧЕНКО).

УХВАЛИЛИ: Рекомендувати до захисту кваліфікаційну роботу.

Голова Завідувачка кафедри, проф.	(підпис)	Лілія ВИШНЕВСЬКА
Секретар асистент		Ілона КОНОВАЛЕНКО

НАЦІОНАЛЬНИЙ ФАРМАЦЕВТИЧНИЙ УНІВЕРСИТЕТ

ПОДАННЯ ГОЛОВІ ЕКЗАМЕНАЦІЙНОЇ КОМІСІЇ ЩОДО ЗАХИСТУ КВАЛІФІКАЦІЙНОЇ РОБОТИ

Направляється здобувач вищої освіти Худа ЕЛЬ АМРАНІ до захисту кваліфікаційної роботи за галуззю знань <u>22 Охорона здоров'я</u> спеціальністю 226<u>Фармація, промислова фармація</u> освітньою програмою <u>Фармація</u> на тему: «Розробка складу антибактеріального мила з комплексом ефірних олій»

Кваліфікаційна робота і рецензія додаються.

Декан факультету _____ / Світлана КАЛАЙЧЕВА /

Висновок керівника кваліфікаційної роботи

Здобувач вищої освіти Худа ЕЛЬ АМРАНІ представила кваліфікаційну роботу, яка за об'ємом теоретичних і практичних досліджень повністю відповідає вимогам до оформлення кваліфікаційних робіт.

Керівник кваліфікаційної роботи

Катерина СЕМЧЕНКО

«12» квітня 2023 р.

Висновок кафедри про кваліфікаційну роботу

Кваліфікаційну роботу розглянуто. Здобувач вищої освіти Худа ЕЛЬ АМРАНІ допускається до захисту даної кваліфікаційної роботи в Екзаменаційній комісії.

Завідувачка кафедри аптечної технології ліків

Лілія ВИШНЕВСЬКА

«26» квітня 2023 року

Qualification work was defended

of Examination commission on

« » <u>June</u> 2023

With the grade _____

Head of the State Examination commission,

D Pharm Sc, Professor

_____ / Oleh SHPYCHAK /